ERCB

Pembina Pipeline Corporation Crude Oil Pipeline Failure Licence No. 1386, Line No. 003 June 15, 2008

ERCB Investigation Report

February 11, 2009

Report prepared by Brian Temple (Incident Investigator), Doug Buechler (Field Surveillance), Dave Grzyb (Operations), Murray Barber (Field Surveillance), Jenny Miller, Phil Hendy (Emergency Planning and Assessment), Mike Bevan (Environment)

Energy Resources Conservation Board

ENERGY RESOURCES CONSERVATION BOARD
ERCB Investigation Report: Pembina Pipeline Corporation, Crude Oil Pipeline Failure

February 11, 2009

Published by

Energy Resources Conservation Board
640 – 5 Avenue SW
Calgary, Alberta
T2P 3G4

Telephone: 403-297-8311
Fax: 403-297-7040
E-mail: infoservices@ercb.ca
Web site: www.ercb.ca

Contents

1 Incident Overview 1

2 Significant Findings 4
- 2.1 Pembina Pipeline Corporation Investigation 4
- 2.2 ERCB's Investigation 5

3 Actions Taken to Prevent Recurrence 5
- 3.1 By Pembina Pipeline Corporation 5
- 3.2 By the ERCB 6

4 ERCB Directed Actions 6

5 ERCB Follow-up 6

1 Incident Overview

At about 9:07 p.m. on Sunday, June 15, 2008, the Pembina Pipeline Corporation (Pembina) Edmonton Control Centre (ECC) supervisory control and data acquisition (SCADA) system detected a possible release in Pembina's 6-inch (152-millimetre) Cremona crude oil pipeline, Licence No. 1386. The pipeline break was later determined to be located at Legal Subdivision (LSD) 13, Section 26, Township 33, Range 5, West of the 5th Meridian, about 5 kilometres (km) north of Sundre where the pipeline runs under the Red Deer River. The pipeline contained light sweet crude oil without any hydrogen sulphide (H_2S).

The pipeline had been shut in since 7:17 p.m. (as part of normal operating protocol), but SCADA indicated flow on incoming and outgoing crude meters with a gradual drop in line pressure. At 9:14 p.m., ECC issued a close command to the crude valve but continued to see flow and loss of pipeline pressure. ECC then notified Pembina staff of the situation.

ECC attempted to isolate the crude system, but the valve would not respond to the ECC command. At 10:02 p.m., Pembina staff completed isolating the crude system by closing manual valves.

At 10:38 p.m., the Energy Resources Conservation Board (ERCB) Red Deer Field Centre (RDFC) was notified of the incident by Pembina. The Sundre Petroleum Operators Group (SPOG) also notified the ERCB that it had received an odour complaint and was investigating. Pembina staff continued to search for the exact location of the release, and at 10:49 p.m. they became aware of sweet hydrocarbon odours along the Red Deer River.

At 11:16 p.m., ECC completed isolation of the high vapour pressure (HVP) line (carried condensate and butane) that ran parallel to the crude oil pipeline.

At about 11:54 p.m., SPOG confirmed that it had received two odour complaints from opposite sides of the river, approximately 1.6 km downstream of the original odour site. Due to darkness and the Red Deer River running high and fast because of recent heavy rain, the exact source of the odours could not be determined at that time.

High river flows and the murkiness of the river made immediate pipe inspections and crude oil containment impossible. The Pembina emergency response plan (ERP) was activated, an incident command post at the Sundre office was established, and required staff and equipment were mobilized from Pembina District Offices located in Sundre, Drayton Valley, and Edmonton.

On the morning of June 16, 2008, the release site was identified by Pembina staff using helicopter surveillance. The surveillance determined the extent of the release down the river and revealed a large sheen on the west side of Gleniffer Lake and in various locations on the river. The released oil had flowed into Gleniffer Lake about 33 km downstream of the break point. ERCB staff were dispatched to the Pembina Incident Command Post (ICP) in Sundre and to Glenmifer Lake to monitor the spill response and recovery process.

Pembina advised resorts on Gleniffer Lake of the oil release, and drinking water intakes to the resorts were shut off. The resorts used existing drinking water inventory and Pembina ensured that inventory levels were maintained by trucking in water until the David Thompson Health Region (DTHR) declared the water safe for consumption and the water intakes were reopened.

Pembina is a registered member of the Western Canada Spill Service (WCSS) and also owns various types of emergency response equipment, including environmental protection trailers, stocked with booms, absorbent pads, and generators, and specialized boom deployment boats. This equipment, including primary and secondary containment booms (1340 metres [m]), was deployed immediately in Gleniffer Lake to provide containment and prevent the oil sheen from migrating farther down the lake to the Dickson Dam and the Red Deer River. The spill appeared to be contained at the southern point, in an area covering about 15 to 20 per cent of the lake.

In an effort to minimize the potential impact on wildlife, propane-fired "scare cannons" were set up early during response activities. Also, since migratory waterfowl were observed to be congregating on sandbars near the point where the river entered the lake, scarecrows, mylar tape, and other wildlife scare devices from the WCSS wildlife trailer were set up on the sandbars.

Under the direction of Alberta Environment (AENV), cleanup began of the Gleniffer Lake shoreline and about 10 river sites identified by aerial surveillance. Pembina initiated a water sampling program to monitor water quality and a program to provide local landowners and lake users with updates.

At 11:30 a.m., the Alberta Emergency Management Agency (AEMA) activated the government emergency operations centre (GEOC) in Edmonton to coordinate the government response among the various agencies, including the ERCB and the Alberta Environment Support and Emergency Response Team. The ERCB set up an incident command post at the RDFC to handle incident updates and to coordinate the ERCB response.

The release site was examined by Pembina staff who confirmed that there was no further release from the pipeline. However, because the pipeline might still have contained product, vacuum trucks were used to begin removing any product in the line from the east side of the river valley, and the HVP line that ran parallel to the crude pipeline was purged with nitrogen.

On June 17, 2008, cleanup activities continued, using air boats, booms, skimmers, and 20 to 25 labourers, with 2.5 km of lakeshore cleaned. The Workplace Health and Safety inspector on location expressed concern about whether Pembina's responders had been trained to work around water. Pembina's representative on location indicated full support for safe work practices. Onshore workers wore standard and appropriate levels of personal protective equipment and people working on or near the water wore personal floatation devices.

Vacuum trucks removed 1.1 cubic metres (m^3) of oil from the east side of the pipeline failure site and 2 m^3 from the west side. Pembina contracted Golder Associates Ltd. and Intrinsik Environment to conduct water sampling at various locations around the lake, including the inlets at Gleniffer Resort and Carefree Resort, downstream of the dam, and at the Innisfail Anthony Henday Water Treatment Plant. To monitor water quality, well over 200 samples were collected for laboratory analysis.

Pembina continued to communicate with local landowners, lake users, and Carefree Resort and Gleniffer Lake Resort representatives. Pembina's land agent made contact with residents and land users along the portion of the river where the spill occurred.

Water samples were also collected from any location where landowners or residents had concerns about water quality impact on livestock. These samples were analyzed and the

results were provided to the relevant landowners or residents. The samples were also made available to AENV.

From June 18 to July 2, 2008, the following took place:

- ERCB representatives stayed on location at the ICP in Sundre, at Glenniffer Lake, and at GEOC. The RDFC continued coordinating ERCB communications.
- Pembina continued to monitor the break site for further release.
- Pembina posted hazard signs at the break site since the booms would remain until the site was inspected and declared safe.
- Pembina continued cleanup activities and the water sampling program on Glenniffer Lake and the Red Deer River and increased cleanup staff to 63.
- Helicopter flights revealed minimal evidence of oil contamination on the river.
- Pembina confirmed that a pig was lodged in a section of the pipeline and that it might be holding a significant amount of oil back within the pipeline. The pig was subsequently found in a valve at the west block valve pig receiver.
- Pembina applied to Fisheries and Oceans Canada (DFO) to redirect the river to isolate the leak with the support of AENV.
- Pembina began a program of public meetings and open houses at various locations (Carefree Resort, Glenniffer Lake Resort, Red Deer County, Sundre) with representatives from the ERCB and AENV in attendance.
- To monitor for wildlife impacts, Pembina staff walked the shoreline during daylight hours each day during spill cleanup operations.
- AENV became the lead agency for the cleanup and issued an Environmental Protection Order.
- All resorts continued to be under water restrictions, while Pembina continued to haul water to the resorts to maintain their drinking water inventory.
- The DTHR issued a recreational water advisory.
- Vacuum trucks continued to remove oil from the pipeline.
- On June 25, the lakeshore cleanup was completed, while the river shoreline cleanup continued.
- On June 26, Glenniffer Lake was reopened for recreational use by the DTHR.
- On June 27, the DTHR and AENV allowed the water intakes to be reopened at Glenniffer Lake Resort and Carefree Resort.

Repair efforts in July involved submitting regulatory applications to AENV, Transport Canada, the ERCB, and DFO. A verbal approval was received from AENV on July 11 that allowed the salvage of timber, clearing of the expanded right-of-way, and installation of a temporary access road to the river's edge for delivery of equipment.

On July 16, repair crews determined that the river flow had subsided sufficiently to allow divers to install a leak clamp on the pipeline. The clamp was installed and the line was purged with nitrogen.

By best estimates, 58 barrels (9.25 m^3) of oil were recovered from the pipeline from the east side of the break using vacuum trucks and an additional 90 barrels (14.3 m^3) of oil were recovered from the west side of the break, for a total of 148 barrels (23.55 m^3) of oil recovered from the failed pipeline.

Once the failed pipeline was clamped and purged and no additional oil could leak into the river, AENV allowed removal of the containment booms from the river and lake.

By July 25, all regulatory permits had been received and work commenced to isolate the Red Deer River channel where the pipeline was exposed. A diversion channel was excavated, an upstream dam constructed, and the river completely diverted by July 27. A downstream dam was installed and the failed pipe was removed from the river and sent to Acuren Group Inc. (Acuren) for analysis.

Excavation of the new trench commenced in August within the existing riverbed and throughout the floodplain. The existing pipelines (crude oil and HVP) were removed prior to the installation of new pipelines (about 800 m in length) and reconstruction was completed on August 14.

A pressure test was successfully completed on the pipelines on August 17, and the lines were placed back into service on August 25 with approval from the ERCB. Reseeding of the disturbed area and silt fences to control sediment runoff were installed prior to September 1. The silt fences will be removed prior to the spring freshet in 2009.

The incident was classified as a Level-2 emergency by the ERCB and Pembina. The release site was in a major waterway and the incident received media attention.

A press release was issued by the ERCB Communications Group that the incident would be investigated.

2 Significant Findings

2.1 Pembina Pipeline Corp. Investigation

Once retrieved from the river, the failed section of pipeline was sent to Acuren for inspection and testing. The Acuren report concluded that failure of the section of pipe occurred as a result of one-way bending fatigue. This was due to the supporting soil having been eroded by increased water flow resulting from recent significant rainfall and subsequently the pipe being freely exposed to the current in the Red Deer River.

No indication of any pipe material or welding flaws or deficiencies were found that would have contributed to the failure.

Pembina determined that the reason that the valves could not be closed remotely by the control centre was that the control system design intentionally prevented the two valves from being closed at the same time. This was to allow a flow path at all times and to prevent an overpressure situation from resulting should both valves be closed. Since the incident the control design has been changed to allow closure of both valves at the same time.

Pembina estimated that 177 barrels (28.1 m^3) of oil was released into the river when the line broke, and that perhaps 10 m^3 of that was attributable to the delay in the closure of the valves.

About 6800 kilograms (15 000 lbs) of oil-soaked debris was recovered. The amounts of product recovered from the river and lake were estimated, as recovery efforts focused on gathering oil-soaked debris and separating the oil from the debris was not practical.

On reviewing its incident response, Pembina identified areas for improvement:

- having dedicated media and regulatory liaison representatives at the site,
- having credible technical experts available to discuss the release with both the media and regulatory community, and
- ensuring that key operations personnel receive media training as part of its corporate emergency preparedness program.

2.2 ERCB's Investigation

The ERCB fully reviewed Pembina's evaluation of the incident and the technical explanation of the nature and circumstances of the pipeline failure. The ERCB is satisfied with the evaluation.

All required agencies were contacted.

The Pembina ERP in place was found to be compliant with ERCB *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry*.

Pembina provided an appropriate response to the incident and used all necessary resources.

Pembina maintained communication with and provide updates to all parties, both public and regulatory, throughout the incident.

The ERCB recognizes that Pembina has progressively upgraded its SCADA and leak detection systems since acquiring the Cremona pipeline system. While the delay in valve closure may have contributed to additional oil being released, the ERCB recognizes that the system had been designed to protect against other threats, such as an overpressure condition, and that it is difficult to predict all potential operational scenarios that might occur. In fact, all other mainline block valves in the Pembina system are capable of being closed individually by the control centre. The ERCB is satisfied that the subsequent reprogramming has created a safeguard against the valve closure delay recurring.

The ERCB believes that there were no contraventions of its regulatory requirements with respect to the cause of this incident and subsequent response, including the pipeline repair and environmental remediation.

3 Actions Taken to Prevent Recurrence

3.1 By Pembina Pipeline Corp.

Pembina has replaced the two pipelines (crude oil and HVP) affected by the incident and buried them to a depth of 4 to 5 m for a distance of about 800 m under the same portion of the river in order to mitigate the effects of any further movement of the river.

This installation, in addition to the 800 m already deeply buried in 2004, minimizes the risk of future exposure of the pipeline across the entire Red Deer River crossing at this location.

Pembina will continue to apply its integrity management program to all its pipelines with the objective of identifying hazards that may negatively impact pipeline integrity and mitigating those hazards by appropriate action. As part of its integrity management program, Pembina will do the following:

- Enhance its geotechnical hazard management program by monitoring Environment Canada rain flow and river flow data either electronically or by third-party consultants, and any high precipitation rates or flow rates will trigger a crossing investigation by Pembina staff. If river conditions such as those encountered on the Red Deer River on the day of the incident are encountered again, the pipeline will be shut down and action taken to prevent a release.

- Conduct additional hydrological analysis on braided river crossings, and valve placement will be studied at all locations where Pembina pipelines cross braided or active rivers. As appropriate, line-lowering activities (such as those just completed at the Red Deer River crossing) will be completed at other locations.

- Reflect the knowledge gained from past experience, namely, extra deep burial or horizontal directionally drilled installations should be considered for the complete river channel and not just where the present channel is. Gaining a comprehensive understanding of river hydrology relative to channel movement is essential.

Pembina has committed to share its knowledge relating to the incident with other operators, as appropriate.

3.2 By the ERCB

The ERCB Operations Group (Pipeline Section) will continue to follow up with Pembina on an ongoing basis and will confirm that Pembina has enhanced its integrity management program as summarized above.

4 ERCB Directed Actions

The ERCB has determined that there are to be no directed actions with respect to the nature and circumstances of the pipeline failure, the pipeline repair, and the subsequent activities being pursued to manage other similar pipelines.

5 ERCB Follow-up

- The RDFC will follow up with Pembina on its commitment to share its knowledge relating to the incident with other operators.

- The RDFC will contact upstream river crossing users with similar circumstances to request that they check their lines.

- The ERCB Operations Group will continue to follow up with Pembina, as described in Section 3.2. In addition, the Operations Group will review the regulatory requirements applicable to river crossings to determine whether any enhancements would be beneficial.

- The ERCB investigation report will be posted on the ERCB Web site www.ercb.ca.